

**STIC Database Tracking Number: 315994**

**To: MATTHEW SUCH**  
**Location: JEF-6B85**  
**Art Unit: 2891**  
**Thursday, December 03, 2009**  
  
**Case Serial Number: 10/573,883**

**From: SCOTT SEGAL**  
**Location: EIC2800**  
**JEF-4B55**  
**Phone: (571)272-1314**  
  
**scott.segal@uspto.gov**

## **Search Notes**

**Re: 2,7-Carbazolenevinylene Derivatives as Novel Materials in Producing Organic Based Electronic Devices**

Examiner Such:

Attached are edited search results from the patent and NPL literature in STN. Databases searched included CAS Registry and Chemical Abstracts. While I did find some NPL that pre-dates the application date, all citations found were authored by the same Assignees and Inventors as 10/573,883. For your interest, I have included some of their newer citations as well.

The **asterisked** items are some of the results worth your review (pre-dating the Filing Date). However, I recommend that you browse all the results.

If you would like more searching to be done on this case, or if you have questions or comments, please do not hesitate to contact me.

Respectfully,  
Scott

Scott Segal  
Searcher, STIC-EIC2800  
JEF-4B55, 571-272-1314



# VOLUNTARY SEARCH FEEDBACK



Art Unit \_\_\_\_\_

App./Serial # \_\_\_\_\_

## How did you use your search results?

You may cut and paste into the box below

☐ I02 rejection

☐ I03 rejection

☐ Cited in allowance

} Citations or  
Patents Used

In brief - citation #, author, or patent #

☐ Helped better understand state of the art in technology, or specific invention

☐ Results verified the lack of relevant prior art (helped determine patentability).

Types ☐ Patent(s)

☐ Non-Patent Literature

## COMMENTS

Questions about the scope or the results of the search?

Contact your EIC searcher or EIC Supervisor.

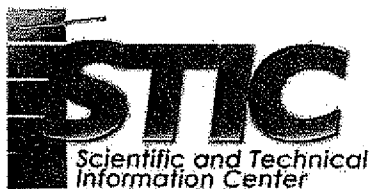
Please submit completed form to your EIC.

## STIC USE ONLY

01/09

Today's Date \_\_\_\_\_

Additional Notes if applicable (please indicate all actions including emails, phone calls, and individuals assisting):



# EIC 2800 SEARCH REQUEST



315994

DEC 2 2009  
Today's Date 12/2/2009

Name MATTHEW W. SUCH

AU/Org. 2891 Employee # 81973

Bld.&Rm.# JEF 6B85 Phone 2-8895

Priority App. Filing Date 10/2/2003

Case/App. # 10/573883

## Format for Search Results

EMAIL ☒ PAPER ☐

If this is an Appeals case, check here ☐

Describe this invention in your own words

*Please search the 4 compounds  
listed on the attached page.*

Synonyms

*Thanks!*

## Additional Comments

Please submit completed form to your EIC.

## STIC USE ONLY

Searcher Scott Segal

Date Completed 12/3/09

Phone 2-1314

Sources CAS Registry, Chemical Abstracts

~~10/573833~~ 10/573883

Priority Date: 2 October 2003

- ① 1,4-bis(vinylene-(N-methyl-7-hexyl-2-carbazole))phenylene
- ② 1,4-bis(vinylene-(N-hexyl-2-carbazole))phenylene
- ③ [Poly (N-(2-ethylhexyl-2,7-carbazolenevinylene- co-2,5-bis(diphenylamine)-1,4-phenylenevinylene-co-((4-(2-ethylhexyloxy)- phenyl)-bis-(4'-phenylene)amine)]
- ④ [Poly (N-(4-hexyloxyphenyl)-2,7-carbazolenevinylene-alt-(3-hexyl-2,5-thiophenevinylene))]

10/573,883

12/3/09

STN

Search History

10:06:08 ON 03 DEC 2009

11:46:38 ON 03 DEC 2009

FILE 'HCAPLUS' ENTERED AT 10:06:16 ON 03 DEC 2009

L1 0 SEA ABB=ON PCVDPATA  
L2 0 SEA ABB=ON PPCVT  
L3 4 SEA ABB=ON RCPCR  
D ALL 1-4

FILE 'REGISTRY' ENTERED AT 10:07:52 ON 03 DEC 2009

L4 1 SEA ABB=ON 844886-65-3/RN  
SET NOTICE 500 DISPLAY  
D L4 SQIDE 1-  
SET NOTICE LOGIN DISPLAY  
L5 1 SEA ABB=ON 887781-96-6/RN  
SET NOTICE 500 DISPLAY  
D L5 SQIDE 1-  
SET NOTICE LOGIN DISPLAY  
L6 0 SEA ABB=ON RCPCR/CN  
L7 2 SEA ABB=ON CPC/CN  
D 1-2  
L8 0 SEA ABB=ON PCVDPAP/CN  
L9 0 SEA ABB=ON PCVDPAP  
L10 0 SEA ABB=ON PCVDPATA  
L11 0 SEA ABB=ON PCVDPATA/CN  
E 1,4-BIS(VINYLENE-(N-METHYL-7-HEXYL)/CN  
E 1,4-BIS(VINYLENE-(N-METHYL-7/CN  
E 1,4-BISVINYLENE-(N-METHYL-7/CN  
E 1,4-BIS(VINYLENE-(N-METHYL/CN  
E 1,4-BIS(VINYLENE/CN

FILE 'HCAPLUS' ENTERED AT 10:12:26 ON 03 DEC 2009

L12 2 SEA ABB=ON ?METHYL-7-HEXYL-2-CARBAZOLE?  
L13 3 SEA ABB=ON ?HEXYL-2-CARBAZOLE?  
L14 1 SEA ABB=ON ?ETHYLHEXYL-2,7-CARBAZOLENEVINYLENE?  
L15 0 SEA ABB=ON ?HEXYLOXYPHENYL(W)2,7-CARB?  
L16 0 SEA ABB=ON ?HEXYLOXYPHENYL(1W)2,7-CARB?  
L17 971 SEA ABB=ON ?HEXYLOXYPHENYL?  
L18 0 SEA ABB=ON ?HEXYLOXYPHENYL? AND ?CARBAZOLENE?  
L19 0 SEA ABB=ON ?HEXYLOXYPHENYL? AND ?THIOPHENEVINYLENE?  
L20 30 SEA ABB=ON ?THIOPHENEVINYLENE?  
L21 0 SEA ABB=ON L20 AND ?HEXYLOXYPHENYL?  
L22 1 SEA ABB=ON L20 AND ?OXYPHENYL?  
L23 4 SEA ABB=ON (L12 OR L13 OR L14) OR L22  
D ALL 1-4

FILE 'REGISTRY' ENTERED AT 11:25:24 ON 03 DEC 2009

L24 14 SEA ABB=ON (695170-05-9 OR 695170-25-3 OR 844886-65-3 OR  
844886-70-0 OR 31110-89-1 OR 695169-64-3 OR 844886-59-5 OR  
844886-60-8 OR 844886-61-9 OR 844886-62-0 OR 844886-63-1 OR  
844886-64-2 OR 887781-97-7 OR 887781-97-7 OR 887781-98-8)/RN  
L25 1 SEA ABB=ON (695170-05-9 OR 695170-25-3 OR 844886-65-3 OR  
844886-70-0 OR 31110-89-1 OR 695169-64-3 OR 844886-59-5 OR  
844886-60-8 OR 844886-61-9 OR 844886-62-0 OR 844886-63-1 OR  
844886-64-2 OR 887781-97-7 OR 887781-97-7 OR 887781-98-8)/CRN  
L26 14 SEA ABB=ON (695170-02-6 OR 695170-07-1 OR 695170-09-3 OR  
695170-11-7 OR 695170-14-0 OR 695170-16-2 OR 695170-18-4 OR  
695170-20-8 OR 695170-27-5 OR 695170-29-7 OR 695170-31-1 OR  
695170-05-9 OR 695170-23-1 OR 695170-25-3)/RN  
L27 0 SEA ABB=ON (695170-02-6 OR 695170-07-1 OR 695170-09-3 OR  
695170-11-7 OR 695170-14-0 OR 695170-16-2 OR 695170-18-4 OR  
695170-20-8 OR 695170-27-5 OR 695170-29-7 OR 695170-31-1)/CRN  
L28 14 SEA ABB=ON (695270-23-1 OR 844886-66-4 OR 844886-66-4 OR  
844886-67-5 OR 844886-68-6 OR 844886-71-1 OR 844886-72-2 OR  
844886-73-3 OR 844886-74-4 OR 944131-83-3 OR 944131-88-8 OR  
944131-79-7 OR 944131-84-4 OR 944131-80-0 OR 944131-70-8 OR  
944131-77-5)/RN  
L29 0 SEA ABB=ON (695270-23-1 OR 844886-66-4 OR 844886-66-4 OR  
844886-67-5 OR 844886-68-6 OR 844886-71-1 OR 844886-72-2 OR

844886-73-3 OR 844886-74-4 OR 944131-83-3 OR 944131-88-8 OR  
944131-79-7 OR 944131-84-4 OR 944131-80-0)/CRN  
L30 15 SEA ABB=ON {944131-85-5 OR 944131-81-1 OR 944131-86-6 OR  
844886-57-3 OR 844886-56-2 OR 944131-82-2 OR 944131-87-7 OR  
944131-68-4 OR 944131-66-2 OR 944131-70-8 OR 944131-72-0 OR  
944131-74-2 OR 944131-76-4 OR 944131-77-5 OR 944131-64-0 OR 944131-76-4)/RN  
L31 6 SEA ABB=ON {944131-85-5 OR 944131-81-1 OR 944131-86-6 OR  
844886-57-3 OR 844886-56-2 OR 944131-82-2 OR 944131-87-7 OR  
944131-68-4 OR 944131-66-2 OR 944131-70-8 OR 944131-72-0 OR  
944131-74-2 OR 944131-76-4 OR 944131-77-5 OR 944131-64-0)/CRN  
L32 15 SEA ABB=ON {695169-57-4 OR 695169-60-9 OR 695169-62-1 OR  
695169-64-3 OR 695169-65-4 OR 695169-67-6 OR 695169-69-8 OR  
695169-71-2 OR 695169-75-6 OR 695169-77-8 OR 695169-79-0 OR  
695169-81-4 OR 695169-91-6 OR 695169-93-8 OR 695169-95-0)/RN  
L33 15 SEA ABB=ON {695169-97-2 OR 695169-99-4 OR 844886-57-3 OR  
844886-59-5 OR 844886-55-1 OR 844886-57-3 OR 844886-58-4 OR  
844886-61-9 OR 844886-63-1 OR 844886-64-2 OR 845507-59-7 OR  
944131-85-5 OR 944131-82-2 OR 944131-87-7 OR 944131-66-2 OR 944131-68-4)/RN  
L34 73 SEA ABB=ON {L24 OR L25 OR L26 OR L27 OR L28 OR L29 OR L30 OR L31 OR L32 OR L33}

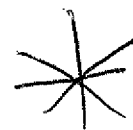
FILE 'HCAPLUS' ENTERED AT 11:26:33 ON 03 DEC 2009

L35 13 SEA ABB=ON L34  
L36 8 SEA ABB=ON {695170-05-9 OR 695170-25-3 OR 844886-65-3 OR  
844886-70-0 OR 31110-89-1 OR 695169-64-3 OR 844886-59-5 OR  
844886-60-8 OR 844886-61-9 OR 844886-62-0 OR 844886-63-1 OR  
844886-64-2 OR 887781-97-7 OR 887781-97-7 OR 887781-98-8)/RN  
L37 4 SEA ABB=ON {695170-02-6 OR 695170-07-1 OR 695170-09-3 OR  
695170-11-7 OR 695170-14-0 OR 695170-16-2 OR 695170-18-4 OR  
695170-20-8 OR 695170-27-5 OR 695170-29-7 OR 695170-31-1 OR  
695170-05-9 OR 695170-23-1 OR 695170-25-3)/RN  
L38 3 SEA ABB=ON {695270-23-1 OR 844886-66-4 OR 844886-66-4 OR  
844886-67-5 OR 844886-68-6 OR 844886-71-1 OR 844886-72-2 OR  
844886-73-3 OR 844886-74-4 OR 944131-83-3 OR 944131-88-8 OR  
944131-79-7 OR 944131-84-4 OR 944131-80-0 OR 944131-70-8 OR 944131-77-5)/RN  
L39 3 SEA ABB=ON {944131-85-5 OR 944131-81-1 OR 944131-86-6 OR  
844886-57-3 OR 844886-56-2 OR 944131-82-2 OR 944131-87-7 OR  
944131-68-4 OR 944131-66-2 OR 944131-70-8 OR 944131-72-0 OR  
944131-74-2 OR 944131-76-4 OR 944131-77-5 OR 944131-64-0 OR 944131-76-4)/RN  
L40 8 SEA ABB=ON {695169-57-4 OR 695169-60-9 OR 695169-62-1 OR  
695169-64-3 OR 695169-65-4 OR 695169-67-6 OR 695169-69-8 OR  
695169-71-2 OR 695169-75-6 OR 695169-77-8 OR 695169-79-0 OR  
695169-81-4 OR 695169-91-6 OR 695169-93-8 OR 695169-95-0)/RN  
L41 6 SEA ABB=ON {695169-97-2 OR 695169-99-4 OR 844886-57-3 OR  
844886-59-5 OR 844886-55-1 OR 844886-57-3 OR 844886-58-4 OR  
844886-61-9 OR 844886-63-1 OR 844886-64-2 OR 845507-59-7 OR  
944131-85-5 OR 944131-82-2 OR 944131-87-7 OR 944131-66-2 OR 944131-68-4)/RN  
L42 13 SEA ABB=ON {L35 OR L36 OR L37 OR L38 OR L39 OR L40 OR L41)  
L43 9 SEA ABB=ON L42 NOT L23  
D ALL 1-9  
E MORIN J, 2001/RE  
L44 3 SEA ABB=ON {MORIN? AND LECLERC?)/AU AND 2001/PY  
D ALL 1-3  
L45 14 SEA ABB=ON {MORIN? AND LECLERC?)/AU AND 2002/PY  
L46 0 SEA ABB=ON L45 AND MACROMOLECULES/JN  
L47 0 SEA ABB=ON L45 AND MACROMOLECULES  
L48 0 SEA ABB=ON L45 AND V34  
L49 0 SEA ABB=ON L45 AND V35  
L50 0 SEA ABB=ON L45 AND 8413  
E MORIN J, 2002/RE  
L51 2 SEA ABB=ON L45 AND MACROMOLECULES/JT  
D ALL 1-2  
L52 14 SEA ABB=ON {MORIN? AND LECLERC?)/AU AND 2002/PY  
L53 1 SEA ABB=ON L52 AND MACROMOLECULAR RAPID COMMUNICATIONS/JT  
D ALL  
L54 1 SEA ABB=ON {MORIN? AND TAO? AND LECLERC?)/AU AND 2002/PY  
D ALL  
L55 0 SEA ABB=ON {MORIN? AND BEAUPRE? AND LEVESQUE?)/AU AND 2002/RE  
L56 0 SEA ABB=ON {MORIN? AND LEVESQUE?)/AU AND 2002/RE

10/573,883

12/3/09

STN

Same Inventors +  
Assignees as  
10/573,883

L51 ANSWER 1 OF 2 COPYRIGHT ACS on STN

AN 2002:737955 HCAPLUS

TI 2,7-Carbazole-Based Conjugated Polymers for  
Emission

light

AU Morin, Jean-Francois; Leclerc, Mario

CS Centre de Recherche en Sciences et Ingenierie des Macromolecules,  
Departement de Chimie, Universite Laval, Quebec City, QC, G1K 7P4, Can.SO Macromolecules (2002), 35(22), 8413-8417

CODEN: MAMOBX; ISSN: 0024-9297

PB American Chemical Society

DT Journal

LA English

AB Light-emitting 2,7-carbazole-based homopolymers and copolymers were prepared by Yamamoto or Suzuki cross-coupling reaction. Poly(N-(2-ethylhexyl)-2,7-carbazole) (PEHC), poly(N-octadecyl-2,7-carbazole) (PODC), and poly(N-(2-ethylhexyl)-2,7-carbazole-alt-4-heptyl-2,5-pyridine) (PCPy) emit blue light while poly(N-(2-ethylhexyl)-2,7-carbazole-alt-2,3-diheptyl-5,8-quinoxaline) (PCQ) and poly(N-(2-ethylhexyl)-2,7-carbazole-alt-3,3',4'',3'''-tetramethyl-3'',4'''-dihexyl-2,2':5',2'':5'',2''':5''',2''''-quinquethiophene-1'',1'''-dioxide) (PCPTO) emit green and red light, resp. The fluorescence quantum yield in chloroform solution ranges from 25% for PCPTO to 83% for PCQ. All these 2,7-carbazole-based polymers do not show any evidence of excimer formation in the solid state. Most of these polymers exhibit a glass transition at ca. 60-70 °C with a degradation temperature above 385 °C. These new polymeric materials should allow the development of efficient blue-, green-, and red-light-emitting diodes with improved optical stability.

IT Fluorescence

Glass transition temperature

UV and visible spectra

(of 2,7-carbazole-based conjugated polymers for blue, green, and red light emission)

IT Suzuki coupling reaction

(used in the preparation of 2,7-carbazole-based conjugated polymers for blue, green, and red light emission)

IT 353276-27-4P 353276-28-5P 444289-49-0P,

Poly(9-octyl-9H-carbazole-2,7-diyl) 476360-82-4P 476360-85-7P

476360-86-8P 476360-88-0P 476360-89-1P 476360-90-4P 476360-91-5P

476614-67-2P

RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)

(preparation of 2,7-carbazole-based conjugated polymers for blue, green, and red light emission using Yamamoto or Suzuki cross-coupling reaction)

Same Assignee +  
Inventors as  
10/573,883



10/573,883

12/3/09

STN

L44 ANSWER 2 OF 3 COPYRIGHT ACS on STN

AN 2001:404859 HCAPLUS

TI Syntheses of Conjugated Polymers Derived from N-2

AU Morin, Jean-Francois; Leclerc, Mario

CS Canada Research Chair in Polymer Chemistry Department of Chemistry Centre  
de Recherche en Sciences et Ingenierie des Macromolecules, Universite  
Laval, Quebec City, QC, G1K 7P4, Can.

SO Macromolecules (2001), 34(14), 4680-4682

PE American Chemical Society

DT Journal

LA English

AB N-alkyl-2,7-dichlorocarbazoles were prepared in three straightforward steps, Suzuki coupling, reductive Cadogan ring closure, and alkylation. Homopolymers were achieved by reductive Yamamoto reaction of N-alkyl-2,7-dihalo-carbazoles in the presence of P(Ph)<sub>3</sub>, Zn, 2,2'-bipyridine, and NiCl<sub>2</sub> catalyst system. Alternating conjugated copolymers were prepared by Suzuki coupling of diboronic functionalized aromatic compds. and N-alkyl-2,7-diiodocarbazole (or dibromo) derivs. The resulting conjugated poly(N-octyl-2,7-carbazole-alt-9,9-dioctyl-2,7-fluorene)s are completely soluble in common organic solvents, such as chloroform and THF. However, poly(N-octyl-2,7-carbazole) and poly[N-(2-ethylhexyl)-2,7-carbazole] are only partially soluble (ca. 50 % fraction) and an even smaller fraction (ca. 10 %) of poly[N-(2-ethylhexyl)-2,7-carbazole-alt-5,5'-(2,2'-bithiophene)] is soluble in these solvents. In dilute solns. or as thin films poly(N-octyl-2,7-carbazole) exhibits an absorption maximum around 380-390 nm, leading to a pale yellow color and does not exhibit thermochromic or solvatochromic properties, however it has an intense blue emission upon radiative excitation, with a quantum yield of about 80% in chloroform, at room temperature. The pale yellow poly(N-octyl-2,7-carbazole-alt-9,9-dioctyl-2,7-fluorene) exhibits solution and solid-state blue emission (without the presence of excimer) with a maximum at 417 and 450 nm, resp. Poly[N-(2-ethylhexyl)-2,7-carbazole-alt-5,5'-(2,2'-bithiophene)] emits a green radiation with a maximum of emission at 504 nm, the fluorescence quantum yield is 30%. Structural modifications through the synthesis of alternating copolymers makes it feasible to develop tunable light-emitting polymers.

IT Heterocyclization

(Cadogan; coupling-ring closure-alkylation route in preparation of N-alkylcarbazoles and coupling polymerization to obtain conjugated homopolymers and copolymers with bithiophene)

IT 6402-13-7P, 2,7-Diaminocarbazole 102871-58-9P 192942-45-3P

344863-34-9P 353276-18-3P 353276-21-8P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)

(intermediate; coupling-ring closure-alkylation route in preparation of N-alkylcarbazoles and coupling polymerization to obtain conjugated homopolymers and copolymers with bithiophene)



10/573,883

12/3/09

STN

Same Assignee  
+ Inventors  
as 10/573,883



L51 ANSWER 2 OF 2 COPYRIGHT ACS on STN

AN 2002:101801 HCAPLUS

TI Electrochemical, conductive, and magnetic pro  
2,7-carbazole-based conjugated polymersAU Zotti, Gianni; Schiavon, Gilberto; Zecchin, Sandro; Morin,  
Jean-Francois; Leclerc, MarioCS Istituto di Polarografia ed Elettrochimica Preparativa, Consiglio  
Nazionale delle Ricerche, Padua, 35020, Italy

SO Macromolecules (2002), 35(6), 2122-2128

CODEN: MAMOBX; ISSN: 0024-9297

PB American Chemical Society

DT Journal

LA English

AB Novel poly(2,7-carbazole)s (i.e., poly(N-octyl-2,7-carbazole-diyl) and poly(N-(4-hexyl-benzoyl)-2,7-carbazole-diyl)) and their alternating thiophene, bi-thiophene, and 3,4-ethylenedioxy-2,5-thienylene copolymers have been investigated by cyclic voltammetry, UV-vis spectroelectrochem., electrochem. quartz crystal microbalance, in-situ ESR, and in-situ conductivity techniques. All polymer films undergo reversible oxidation and partially reversible reduction processes. In poly(N-octyl-2,7-carbazole-diyl), two isoelectronic oxidation processes produce radical cations and dication with charge localization at the carbazole subunits. The presence of a strong electron-withdrawing substituent onto the nitrogen atom in the homopolymer leads to an increase by 3 orders of magnitude of the conductivity (i.e.,  $1 + 10^{-2}$  S/cm). Similarly, in alternating copolymers, the oxidative charge is more delocalized over the polyconjugated backbone with in-situ conductivities in the range of  $4 + 10^{-2}$  -  $4 + 10^{-3}$  S/cm.

ST carbazole thiophene conjugated polymer prepn oxidn cyclic voltammetry cond

IT Cyclic voltammetry

ESR (electron spin resonance)

Optical absorption

Oxidation

Oxidation potential

Polymerization catalysts

Redox potential

(2,7-carbazole-based conjugated polymers)

IT Band gap

Electric conductivity

(electrochem. and optical; 2,7-carbazole-based conjugated polymers)

IT Conducting polymers

(polythiophenes, carbazole group-containing; 2,7-carbazole-based conjugated polymers)

(2,7-carbazole-based conjugated polymers)

IT 50606-95-6, 4-Hexylbenzoyl chloride 102871-58-9, 2,7-Dichlorocarbazole

RL: RCT (Reactant); RACT (Reactant or reagent)

(monomer synthesis; 2,7-carbazole-based conjugated polymers)

IT 406726-90-7P 406726-91-8P 406726-92-9P 406726-93-0P

RL: RCT (Reactant); SPN (Synthetic preparation); PREP (Preparation); RACT (Reactant or reagent)

(monomer; 2,7-carbazole-based conjugated polymers)

IT 603-35-0, Triphenylphosphine, uses 7447-41-8, Lithium chloride, uses

13965-03-2, Bis(triphenylphosphine)palladium dichloride 14221-01-3,

Tetrakis(triphenylphosphine)palladium

RL: CAT (Catalyst use); USES (Uses)

(polymerization catalyst; 2,7-carbazole-based conjugated polymers)

10/573,883

12/3/09

STN

Same Inventions

+  
Assigned as

10/573,883

L53 ANSWER 1 OF 1 COPYRIGHT ACS on STN  
AN 2003:109505 HCAPLUS  
TI Blue-light-emitting conjugated polymers derived from 2,7-carbazoles  
AU Morin, Jean-Francois; Boudreault, Pierre-Luc; Leclerc, Mario  
CS Canada Research Chair in Electroactive and Photoactive Polymers, Centre de recherche en sciences et ingenierie des macromolecules, Departement de chimie, Universite Laval, Quebec City, QC, G1K 7P4, Can.  
SO Macromolecular Rapid Communications (2002), 23(17), 1032-1036  
CODEN: MRCOE3; ISSN: 1022-1336  
PB Wiley-VCH Verlag GmbH & Co. KGaA  
DT Journal  
LA English  
CC 35-5 (Chemistry of Synthetic High Polymers)  
Section cross-reference(s): 36, 73  
AB Blue-light-emitting 2,7-carbazole-based conjugated copolymers have been prepared by Yamamoto or Suzuki cross-coupling reactions. By introducing highly substituted aromatic comonomers, fully soluble high-mol.-weight copolymers have been obtained. Moreover, these amorphous polymeric materials exhibit good thermal stability and interesting redox properties. All these features make these new conjugated polymers highly promising for the development of single-polymer-layer blue-light-emitting diodes.  
ST carbazole contg conjugated polymer synthesis optical thermal electrochem property; blue light emitting diode carbazole contg conjugated polymer  
IT UV absorption  
(UV-visible; of blue-light-emitting conjugated polymers derived from 2,7-carbazoles)  
IT Electroluminescent devices  
(blue-emitting; blue-light-emitting conjugated polymers derived from 2,7-carbazoles)  
IT Polymers, preparation  
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)  
(conjugated; blue-light-emitting conjugated polymers derived from 2,7-carbazoles)  
IT Band gap  
Fluorescence  
Glass transition temperature  
HOMO (molecular orbital)  
LUMO (molecular orbital)  
Luminescence, electroluminescence  
Oxidation potential  
Polymer chains  
Reduction potential  
Thermal stability  
(of blue-light-emitting conjugated polymers derived from 2,7-carbazoles)  
IT Band gap  
(optical; of blue-light-emitting conjugated polymers derived from 2,7-carbazoles)  
IT 515821-39-3P 515821-40-6P 515821-42-8P 515821-43-9P 524944-11-4P  
RL: PRP (Properties); SPN (Synthetic preparation); PREP (Preparation)  
(blue-light-emitting conjugated polymers derived from 2,7-carbazoles)

10/573,883

12/3/09

STN

US Provisional Patent  
Filing date 8/15/03Same Inventors +  
Assignees as 10/573,883

L23 ANSWER 3 OF 4 COPYRIGHT ACS on STN  
 AN 2005:158637 HCAPLUS  
 TI Monomers, oligomers and polymers of 2-functionalized and  
 2,7-difunctionalized carbazoles  
 IN Leclerc, Mario; Morin, Jean-Francois  
 PA Universite Laval, Can.  
 SO PCT Int. Appl., 72 pp.  
 DT Patent  
 LA English

	PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
PI	WO 2005016882	A1	20050224	WO 2004-CA1509	20040816
	CA 2535497	A1	20050224	CA 2004-2535497	20040816
	EP 1660450	A1	20060531	EP 2004-761673	20040816
	JP 2007502251	T	20070208	JP 2006-522863	20040816
	US 20070069197	A1	20070329	US 2006-568303	20061020
<b>PRAI</b>	<b>US 2003-495113P</b>	<b>P</b>	<b>20030815</b>		
	WO 2004-CA1509	W	20040816		

AB The present invention relates to 2-functionalized and 2,7-difunctionalized carbazoles and 2,7 -carbazolevinylene oligomers and polymers. More specifically, the present invention relates to a compound of formula (I): wherein R1 is selected from the group consisting of H, alkyl, and aryl; and wherein R2 and R3 are independently selected from the group consisting of H, alkyl, formyl, hydroxymethyl, trityloxymethyl, acetonitrile, chloromethyl, methylphosphonate, methyltriphenylphosphonium and vinyl. The oligomers and polymers are used in field-effect transistors, light-emitting devices such as light-emitting diodes, and solar cells.

IT **Electroluminescent devices**  
**Field effect transistors**  
**Solar cells**

(production of monomers, oligomers and polymers of 2-functionalized and 2,7-difunctionalized carbazoles)

IT 695170-02-6P, N-Hexyl-2,7-bis(vinylene-phenylene)carbazole 695170-07-1P, N-Hexyl-2,7-bis(vinylene-(N-hexyl-2-carbazole))carbazole 695170-11-7P, 5,5'-Bis(vinylene-(N-hexyl-2-carbazole))-2,2'-bithiophene 695170-14-0P, N-(2-Ethylhexyl)-2,7-bis(vinylene-4-(1,1'-biphenylene))carbazole 695170-16-2P, N-Hexyl-2,7-bis(cyanovinylene-phenylene)carbazole 695170-18-4P 695170-20-8P 695170-23-1P, 2,5-Dioctyloxy-1,4-diformylbenzene-N-(2-ethylhexyl)-2,7-bis(acetonitrile)carbazole copolymer 695170-25-3P 844886-65-3P, 1,4-Bis(vinylene-(N-methyl-7-hexyl-2-carbazole))phenylene 844886-66-4P, N-(2-Ethylhexyl)-2,7-bis(formyl)carbazole homopolymer 844886-67-5P, Poly(N-(2-ethylhexyl)-2,7-carbazolevinylene) 844886-68-6P, 2,5-Dioctyloxy-1,4-diformylbenzene-N-(2-ethylhexyl)-2,7-bis(methyltriphenylphosphonium chloride)carbazole copolymer 844886-70-0P 844886-71-1P 844886-72-2P, 6,6'-Dibromo-2,2'-bis(2"-ethylhexyloxy)-1,1'-binaphthyl-N-(2-ethylhexyl)-2,7-divinylcarbazole copolymer 844886-73-3P 844886-74-4P, 3-Hexyl-2,5-bis(diethyl methylphosphonate)thiophene-N-(4-octyloxyphenyl)-2,7-bis(formyl)carbazole copolymer 845507-59-7P

RL: IMF (Industrial manufacture); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(production of monomers, oligomers and polymers of 2-functionalized and 2,7-difunctionalized carbazoles)

10/573,883

12/3/09

STN

Date too New  
Same Assignee + Inventors  
as 10/573,883

L3 ANSWER 1 OF 4 COPYRIGHT ACS on STN

AN 2005:1178703 HCAPLUS

TI 2,7-carbazolenevinylene-based oligomer thin-film transistor  
mobility through structural orderingAU Drolet, Nicolas; Morin, Jean-Francois; Leclerc, Nicolas; Wakim, Salem;  
Tao, Ye; Leclerc, MarioCS Canada Research Chair on Electroactive and Photoactive Polymers  
Departement de Chimie Centre de Recherche en Sciences et Ingenierie des  
Macromolecules Universite Laval, Quebec City, QC, G1K 7P4, Can.

SO Advanced Functional Materials (2005), 15(10), 1671-1682

PB Wiley-VCH Verlag GmbH &amp; Co. KGaA

DT Journal

LA English

AB We have fabricated organic field-effect transistors based on thin films of 2,7-carbazole oligomeric semiconductors 1,4-bis(vinylene-(N-hexyl-2-carbazole))phenylene (CPC), 1,4-bis(vinylene-(N'-methyl-7'-hexyl-2'-carbazole))benzene (RCPCR), N-hexyl-2,7-bis(vinylene-(N-hexyl-2-carbazole))carbazole (CCC), and N-methyl-2,7-bis(vinylene-(7-hexyl-N-methyl-2-carbazole))carbazole (RCCCR). The organic semiconductors are deposited by thermal evaporation on bare and chemical modified silicon dioxide surfaces (SiO<sub>2</sub>/Si) held at different temps. varying from 25 to 200°C during deposition. The resulting thin films have been characterizing using UV-vis and Fourier-transform IR spectroscopies, SEM, and X-ray diffraction, and the observed top-contact transistor performances have been correlated with thin-film properties. We found that these new  $\pi$ -conjugated oligomers can form highly ordered structures and reach high hole mobilities. Devices using CPC as the active semiconductor have exhibited mobilities as high as 0.3 cm<sup>2</sup>V<sup>-1</sup>s<sup>-1</sup> with on/off current ratios of up to 107. These features make CPC and 2,7-carbazolenevinylene-based oligomers attractive candidates for device applications.

IT Crystallization temperature

Electric current-potential relationship

Field effect transistors

Hole mobility

Thin film transistors

(carbazolenevinylene-based oligomer thin-film transistors and high mobility through structural ordering)

IT Electric current carriers

(mobility; carbazolenevinylene-based oligomer thin-film transistors and high mobility through structural ordering)

IT 844886-65-3P

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); SPN (Synthetic preparation); PREP (Preparation); PROC (Process); USES (Uses)

(RCPCR; carbazolenevinylene-based oligomer thin-film transistors and high mobility through structural ordering)

IT 31110-89-1P 695169-64-3P 844886-59-5P 844886-60-8P 844886-61-9P  
844886-62-0P 844886-63-1P 844886-64-2P 887781-97-7P 887781-98-8P

RL: PNU (Preparation, unclassified); RCT (Reactant); PREP (Preparation); RACT (Reactant or reagent)

(carbazolenevinylene-based oligomer thin-film transistors and high mobility through structural ordering)

IT 4546-04-7 105365-50-2 695169-57-4

RL: RCT (Reactant); RACT (Reactant or reagent)

(carbazolenevinylene-based oligomer thin-film transistors and high mobility through structural ordering)

10/573,883

12/3/09

STN

Date too new  
Same Assignments  
+ Inventors as  
10/573,883

L23 ANSWER 1 OF 4 COPYRIGHT ACS on STN  
 AN 2006:1007606 HCAPLUS  
 TI Synthesis of 2,7-carbazolenevinylene-based copolymers and  
 of their **photovoltaic** properties  
 AU Leclerc, Nicolas; Michaud, Alexandre; Sirois, Kathleen; Morin,  
 Jean-Francois; Leclerc, Mario  
 CS Departement de Chimie Centre de Recherche en Sciences et Ingenieries des  
 Macromolecules, Universite Laval, Quebec City, QC, G1K 7P4, Can.  
 SQ Advanced Functional Materials (2006), 16(13), 1694-1704  
 PB Wiley-VCH Verlag GmbH & Co. KGaA  
 DT Journal  
 LA English  
 AB New electroactive and photoactive conjugated copolymers consisting of  
 alternating 2,7-carbazole and oligothiophene moieties linked by vinylene groups  
 were developed. Different oligothiophene units were introduced to study the  
 relation between the polymer structure and the electronic properties. The  
 resulting copolymers are characterized by UV-visible spectroscopy, size-  
 exclusion chromatog., and thermal and electrochem. analyses. Bulk  
 heterojunction photovoltaic cells from different copolymers and a soluble  
 fullerene derivative, [6,6]-phenyl-C61 butyric acid Me ester, were fabricated,  
 and promising preliminary results are obtained. For instance, nonoptimized  
 devices using poly(N-(4-octyloxyphenyl)-2,7-carbazolenevinylene-alt-3',4'-  
 dihexyl-2,2':5',2'':5'',2''':5''',2''''-quinguethiophenevinylene 1'',1''-  
 dioxide) as an absorbing and hole-carrier semiconductor exhibit power  
 conversion efficiency up to 0.8% under air mass (AM) 1.5 illumination. These  
 features make 2,7-carbazolenevinylene-based and related polymers attractive  
 candidates for **solar-cell applications**.  
 IT Solar energy  
 (conversion, efficiency; synthesis of 2,7-carbazolenevinylene-based  
 copolymers and characterization of their photovoltaic properties)  
 IT Amorphous semiconductors  
 Heterojunction solar cells  
 Semiconductor films  
 (synthesis of 2,7-carbazolenevinylene-based copolymers and  
 characterization of their photovoltaic properties)  
 IT 944131-81-1P 944131-86-6P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (PCVTT; synthesis of 2,7-carbazolenevinylene-based copolymers and  
 characterization of their photovoltaic properties)  
 IT 944131-82-2P 944131-87-7P  
 RL: PRP (Properties); SPN (Synthetic preparation); TEM (Technical or  
 engineered material use); PREP (Preparation); USES (Uses)  
 (PCVTTTT; synthesis of 2,7-carbazolenevinylene-based copolymers and  
 characterization of their photovoltaic properties)  
 IT 3779-27-9P, 5-Formyl-2,2'-bithiophene 120762-66-5P,  
 4,4'-Diocetyl-2,2'-bithiophene 161746-04-9P 165393-20-4P  
 204700-93-6P, 4-Octyl-2-Trimethyltinthiophene 227464-61-1P,  
 3',4'-Dihexyl-2,2':5',2''-terthiophene-1',1'-dioxide 844886-56-2P, N-(4-  
 Octyloxyphenyl)-2,7-bis(hydroxymethyl)carbazole 844886-57-3P,  
 N-(4-Octyloxyphenyl)-2,7-bis(formyl)carbazole 944131-62-8P  
 944131-66-2P 944131-68-4P 944131-70-8P 944131-72-0P 944131-74-2P  
 944131-76-4P 944131-77-5P  
 RL: PEP (Physical, engineering or chemical process); PRP (Properties); PUR  
 PREP (Preparation); PROC (Process); RACT (Reactant or reagent)  
 (synthesis of 2,7-carbazolenevinylene-based copolymers and  
 characterization of their photovoltaic properties)

10/573,883

12/3/09

STN

Date too New  
Same Inventors &  
Assignees as  
10/573,883

L23 ANSWER 4 OF 4 COPYRIGHT ACS on STN

AN 2004:471220 HCAPLUS

TI Syntheses and Characterization of Electroactive and Photoactive  
2,7-Carbazolenevinylene-Based Conjugated Oligomers and Polymers

AU Morin, Jean-Francois; Drolet, Nicolas; Tao, Ye; Leclerc, Mario

CS Canada Research Chair in Electroactive and Photoactive Polymers Centre de  
Recherche en Sciences et Ingenierie des Macromolecules Departement de  
Chimie, Universite Laval, Quebec City, QC, G1K 7P4, Can.

SO Chemistry of Materials (2004), 16(23), 4619-4626

CODEN: CMATEX; ISSN: 0897-4756

PB American Chemical Society

DT Journal

LA English

AB This study reports the first syntheses and characterization of 2,7-carbazolenevinylene-based oligomers and polymers. Their relatively straightforward syntheses are mainly based on Horner-Emmons or Knoevenagel coupling reaction leading to well-defined oligomers and polymers. As expected, introduction of vinylene and cyanovinylene unit into the polymer backbone decreases the band gap allowing a fine-tuning of the optical and elec. properties. These electroactive and photoactive organic materials exhibit promising performances in light-emitting devices and field-effect transistors. For instance, preliminary measurements using poly(N-(2-ethylhexyl)-2,7-carbazolenecyanovinylene-alt-2,5-dioctyloxy-1,4-phenylenevinylene) (PCCVP) have revealed orange-red emission with an intensity of 245 cd/m<sup>2</sup> at 10 V, whereas p-type mobility of about  $3.7 \times 10^{-2}$  cm<sup>2</sup>/V·s and an on/off ratio as high as 106 were reached with 1,4-bis(vinylene-(N-hexyl-2-carbazole))phenylene (CPC).

IT Electric current carriers

(mobility; syntheses and characterization of electroactive and photoactive 2,7-carbazolenevinylene-based conjugated oligomers and polymers used in LEDs and FETs)

IT Band gap

**Electroluminescent devices**

Electronic transition

Field effect transistors

Luminescence, electroluminescence

Oxidation, electrochemical

Polymerization

UV and visible spectra

(syntheses and characterization of electroactive and photoactive 2,7-carbazolenevinylene-based conjugated oligomers and polymers used in LEDs and FETs)

IT 9003-53-6D, sulfonated

RL: DEV (Device component use); PRP (Properties); USES (Uses)

(dopant for PEDOT; syntheses and characterization of electroactive and photoactive 2,7-carbazolenevinylene-based conjugated oligomers and polymers and their use in LEDs containing)